cesnet

UltraGrid Update

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UltraGrid Platform

Technology

UltraGrid

- an affordable SW platform for very high-quality interactive video (up to 8K) and audio transmissions
- as low latency as possible on commodity hardware and reasonable networks
- use of commodity (gaming) hardware, laptops, even Raspberry Pi
  - Linux and Windows PC and Mac OS platforms
  - commodity video capture cards, webcams, Ximea cameras
  - commodity sound cards, USB sound cards (ASIO not officially supported)
  - commodity GPU cards
- uncompressed/compressed audio and video

UltraGrid Platform

- Any reasonable network
  - even a couple of Mbps ADSL can do /w lower quality
  - NAT support in development
    - Currently NAT can be traversed manually by fiddling with IP addresses/port assignment
    - Our goal is to have automated NAT traversal and STUN/TURN like solution built in
- Point-to-point and point-to-multipoint transmissions
  - basically a peer-to-peer model
  - a client-server model with central “MCU mixer” with “UltraGrid rooms” in development
- GUI
- Open-source software, BSD (GPL) license
  - https://www.ultragrid.cz/
  - https://github.com/CESNET/UltraGrid/
- User support, community
  - technical community growing on Github
  - ultragrid-dev@cesnet.cz

UltraGrid 1.6

- Development between UltraGrid 1.5 and 1.6
  - 710 files changed, 69448 insertions(+), 39924 deletions(-)
  - basic USB3 Ximea cameras support (the ones used by LoLa)
  - native Windows 10 audio capture and playback support through the Windows WASAPI
  - NDI video capture and playback support
  - 10 and 12 bit video support, GoPro CineForm (SMPTE VC-5) video codec support and tons of improvements towards accurate video processing and representation
  - GUI improvements
  - latest macOS versions support

COVID19 Crisis, UltraGrid and Networked Arts

- Requests for distributed rehearsals started to pop out
- Individual musicians/small bands
  - Totally limited equipment/possibilities
- Home setups
- UltraGrid + JackTrip (+ tpf-tools and packet reflector in UltraGrid)
- We had some success with deployment even in home environments
  - Kudos to Jazzycats (a local jazz band)
  - Still requires someone technically savvy to deploy this
- Limitations
  - Network (18ms latency w/ 23ms jitter on my home DSL connection), bandwidth
    - A reasonable UG deployment requires at least 20Mbps
  - NAT, Firewalls
  - Home routers

What is Brewing?

- NAT support
  - Also thanks to a discussion at NowNet Arts
  - Unfortunately quite complex task
- Many types of NATs (Full cone, Restricted Cone, Port Restricted Cone)
- We have already basic techniques (UDP Hole Punching) in place
- UltraGrid can transit simple NAT implementations with manual fiddling with ports
  - Only one UltraGrid instance can be behind NAT
- What if bot UltraGrid instances are behind NAT
  - STUN server
  - TURN server

What is Brewing?

- UltraGrid “server”
  - UltraGrid basically operates on a peer-to-peer principle (multipoint with packet reflector is still based on that principle)
  - Users are more accommodated to client - server model
- We already have a virtual room mode in the packet reflector
  - Basically a MCU mixer (mixes incoming video streams into predefined layout)
  - “UltraGrid rooms”
- We have already basic techniques (UDP Hole Punching) in place
- UltraGrid can transit simple NAT implementations with manual fiddling with ports
  - Only one UltraGrid instance can be behind NAT
- What if both UltraGrid instances are behind NAT
  - STUN server
  - TURN server

Are there other options?

- Everyone is using Zoom today
  - 174,8 ± 1,0 ms* end-to-end audio latency (datacenter in Ireland)
  - even higher latency with original sound from microphone enabled, high-fidelity music mode and windows audio processing off 😲
- eduMeet
  - completely web browser, WebRTC based solution
  - 222,8 ± 8,5ms* end-to-end audio latency (on-premise deployment at CESNET)
  - **156,9 ± 1,3 ms*** with AGC, AEC and noise suppression off
- Digital-Stage
  - https://digital-stage.org/
  - multipoint audiovisual conferencing tool for art, music, theatre and ensembles
  - prototype in development
  - Windows, macOS and Linux application, web browser support (see eduMeet concerns)
  - *Our own measurements, the SW evolves, results will probably vary for others

Thank you for your attention!

Miloš Liška

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Using Ultragrid

Maria Isabel Gandía Carriedo

Advanced Networking Technology Overview
Network Performing Arts Production Virtual Workshop
27-04-2021

Background – From the Resarch and Education Networks, with Artists

ePormundos Afeto (2011)

Specifi (2014)

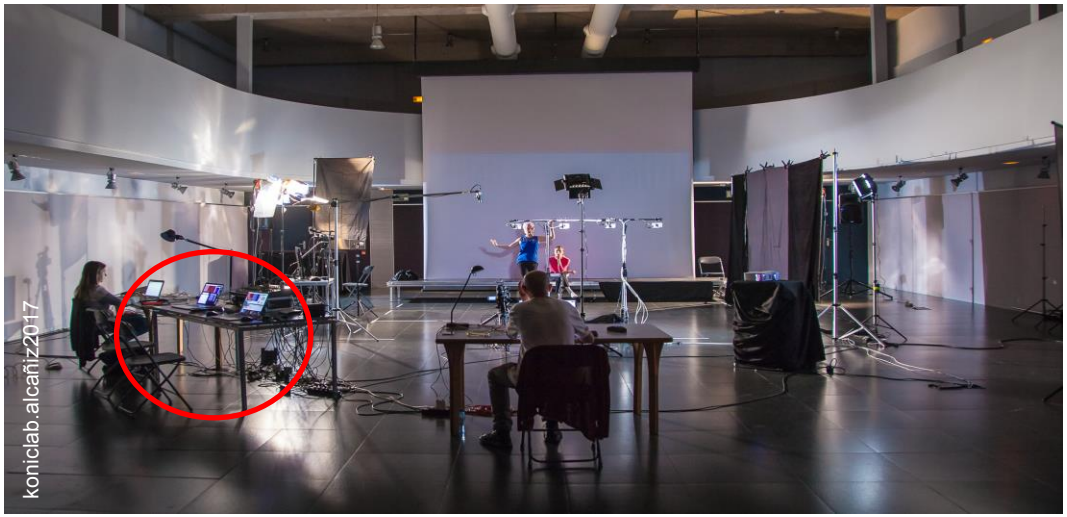
Near in the distance I, II, III (2013, 2015, 2017)

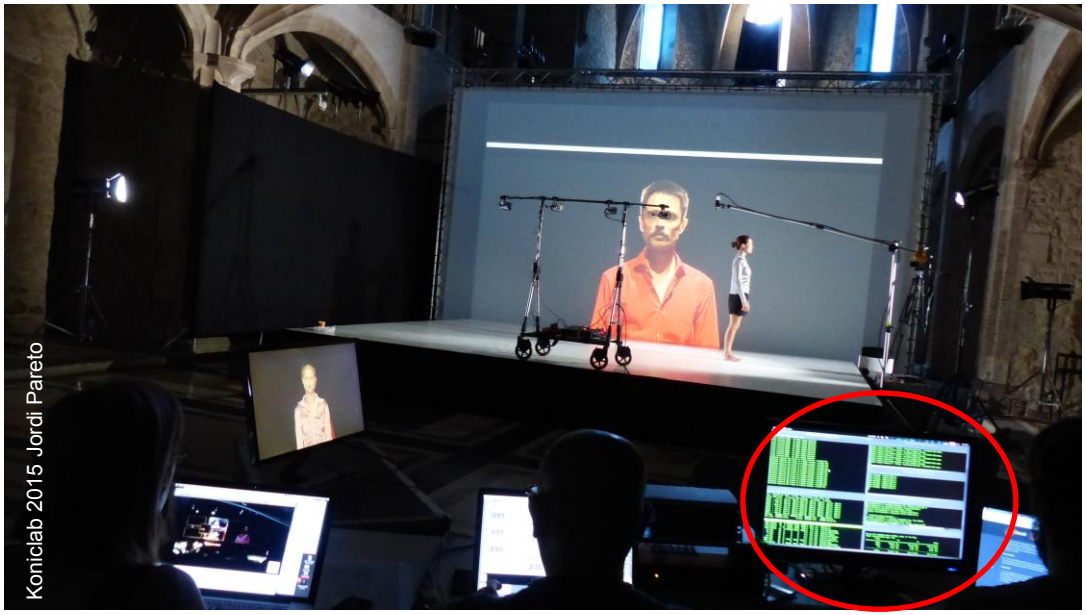
Similarities (2017)

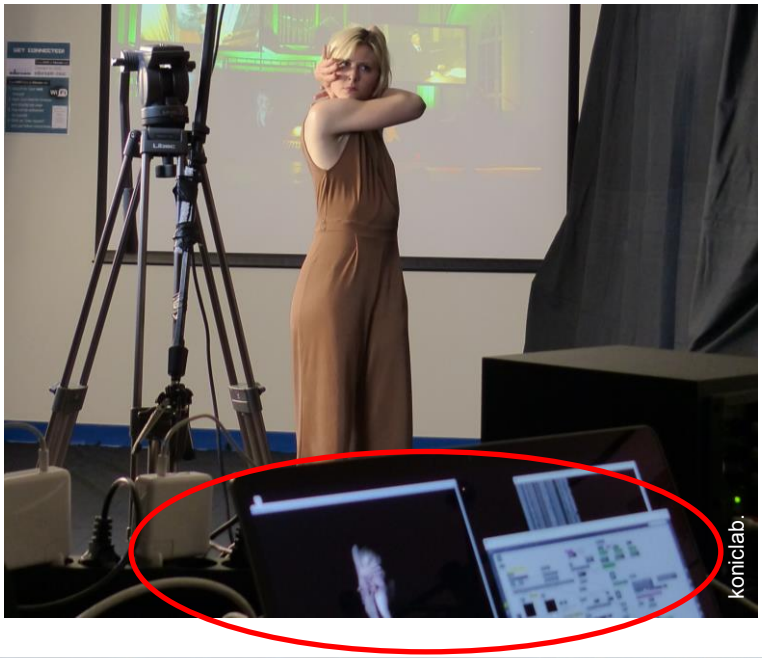
I wish I would dance well under the stars (2019)

A Short Journey into Folded Space (2019)

What do They Have in Common?







High Resolution

Koniclab 2015 Jordi Pareto

High Resolution

Koniclab 2015 Jordi Pareto

22 m^2 screen → 26 square yards

Using Network Technology to improve the Results

Using Network Technology to improve the Results: Jumbo Frames

Great Team

Alumni

- *Martin Beneš*
- *Lukáš Hejtmánek*
- *Petr Holub*
- *Martin Jirman*
- *Jiří Matela*
- *Dalibor Matura*
- *Ondrej Pavelka*
- *Ian Wesley-Smith*
- *Peter Stanko*

http://www.ultragrid.cz/

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Thank you!

And many thanks to the artists, the technicians and all the people that make these performances possible!

Questions?

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